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FOREST VERTEBRATE FAUNA AND LOCAL KNOWLEDGE AMONG THE TANDROY PEOPLE IN BERENTY RESERVE, SOUTHERN MADAGASCAR: A PRELIMINARY STUDY

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ABSTRACT We studied the forest vertebrate fauna of Berenty Reserve and the local Tandroy people's knowledge of these species. Berenty Reserve is a small reserve (about 250 ha) that contains gallery forest, scrub forest, and spiny forest. In spite of the reserve's small size, it has the largest remaining gallery forest in the region. Based on a review of previous reports and our observations, we created a list of forest vertebrate species recorded in the reserve: 27 mammals, 106 birds, 46 reptiles, and 6 amphibians. This result suggests that the forests of Berenty Reserve have relatively high vertebrate diversity for their size. On the other hand, we confirmed the absence of some vertebrate species (e.g., fossa), suggesting that the forest is too small to hold large carnivores. Three species of tenrecs and at least 46 species of birds were recognized as bushmeat for the local Tandroy people, although these species were only hunted opportunistically by young men. However, most mammals, 11 species of birds, and all reptiles and amphibians were not regarded as food. Moreover, small mammals, skinks, geckos, and frogs seemed to be less recognized by the local people. These taxa are also poorly studied by scientists. Thus, small animals (small mammals, reptiles, and amphibians) and their potential extinction risk may be going unnoticed in this small forest.

Key Words: Vertebrate fauna; Tandroy; Madagascar; Conservation; Bushmeat; Food taboos.

INTRODUCTION

Conservation of biodiversity in African tropical forests has come to be considered a global environmental issue. Madagascar has a unique flora and fauna with high rates of endemism (Goodman & Benstead, 2003; 2005). In spite of this uniqueness, it is estimated that more than 90% of Madagascar's natural forest has disappeared and most animals and plants are facing a high risk of extinction (Mittermeier et al., 2010). Madagascar is considered a biodiversity hotspot and a high-priority region for conservation efforts (Myers et al., 2000; Mittermeier et al., 2010).

Despite the recent expansion of Madagascar's protected forest areas, forests in

some areas have already been fragmented (Harper et al., 2007). In these areas, conserving as many small remaining forests as possible is an effective conservation strategy for maintaining high biodiversity as a whole (Ichino, 2007). Although extinction risk for some taxa can increase in small forests, smaller forests are easier to protect, and enforcement can react quicker to various threats (Ichino, 2007). To conserve biodiversity in remaining small forests, it is essential to clarify potential threats and the biodiversity value of these forests.

The research questions of this study are as follows:

1) What is the potential value of small forest biodiversity and what are the threats facing the conservation of that biodiversity?

2) What are the relationships between local knowledge and scientific knowledge?

In this study, we compiled scientific knowledge and local knowledge on the vertebrate fauna of Berenty Reserve, southern Madagascar to answer the above questions. Southern Madagascar is a semi-arid area (Jolly et al., 2006) and gallery forests in the region are highly fragmented (Harper et al., 2007). Although the Berenty Reserve is only 250 ha (including a small area of spiny forest and about 200 ha of gallery and scrub forest), it is the largest remaining forest in the area (Jolly, 2012). Scientific knowledge and local knowledge concerning vertebrate diversity are required to understand the potential value of this small forest for biodiversity conservation in the area.

METHODS

I. Study Site

Berenty Reserve is a 250-ha private reserve owned by the de Heaulme family and is located 86 km west of Fort Dauphin (Fig. 1). Lemurs have been intensively studied in Berenty Reserve by several researchers since the 1960s (Jolly, 2012; Jolly et al., 2006).

II. Data Collection

We conducted a literature review using Google Scholar (https://scholar.google.co.jp/) and the keyword, "Berenty." We excluded unrelated publications from the search results and were left with 363 publications. English and scientific names follow Mittermeier et al. (2010) for lemurs, Garbutt (2007) for other mammals, Hawkins et al. (2015) for birds, and Glaw & Vences (2007) for amphibians and reptiles.

Field observations were conducted by two authors, Ichino and Maehata. Ichino studied the social behavior of ring-tailed lemurs (*Lemur catta*) over 22 field surveys since 1998 for a total length of stay at Berenty exceeding four years. Maehata conducted two intensive field surveys of the bird communities at Berenty, 54 days from September 1–October 24, 2011 and 51 days from July 21–September 9, 2011 (105 days total) (Maehata, 2013). Maehata and Ichino also conducted

additional field work for a month from February 13 to March 11, 2016.

We set five automatic camera traps (BMC SG570-12mHD) within the reserve in the dry (November 9–16, 2016) and rainy seasons (February 17–March 23, 2017) to survey for nocturnal carnivores. Cameras were strapped to trees ~50 cm above the ground. Few nocturnal carnivore species inhabit southern Madagascar (Garbutt, 2007), and we could easily identify the species captured in camera trap movies or photos.

In addition, two authors (Ichino and Rakotondraparany) conducted a preliminary survey of small vertebrates by setting 10 pit-fall traps for two weeks from August 2–15, 2017 within Berenty reserve.

Field interviews with local Tandroy people were conducted by an author (Ichino) during the following five field trips: (1) April 18–28, 2015; (2) February 13–March 11, 2016; (3) September 2–November 17, 2016; (4) February 2–March 23, 2017; and (5) August 1–15, 2017. Bushmeat consumption can be a sensitive issue for local people, particularly around protected areas. Therefore, we collected local information concerning bushmeat consumption from a single reliable 67-year-old Tandroy woman living in Andavabaza Village across the Mandrare River from Berenty Reserve (Fig. 1). She was born in 1950 in Berenty Village and moved to Andavabaza Village when she got married at age 15 years. After about 30 years in Andavabaza Village, she lived in Berenty Reserve for 10 years from 1999 to 2009 as a wife of a reserve security guard. We collected information from our local informant concerning local vertebrate names and how these animals are utilized by the local people. Many locals in Berenty Village were immigrants, mostly Tanosy people from Fort Dauphin and Tandroy people from Ambovombe (Fig. 1), who were originally sisal plantation and factory workers. To avoid confusion with languages of other ethnic groups or regions, we always confirmed that words (e.g., animal names) were in Tandroy. To confirm the accuracy of information from our main informant, we also conducted brief field interviews of some local Tandroy men including a 62-year-old man known by the reserve staff for his vast knowledge of forest animals.

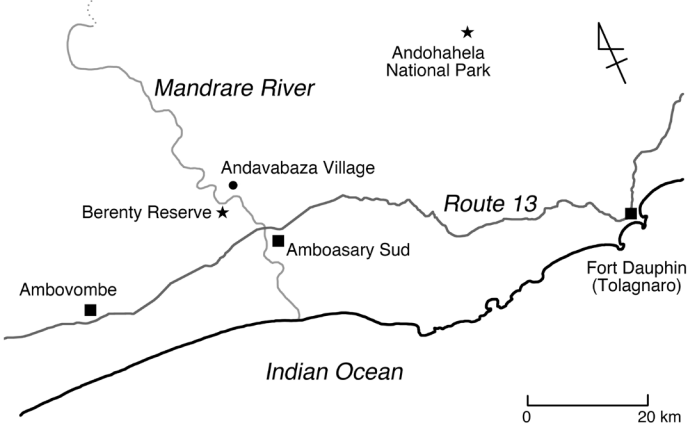

Fig. 1. Map of southeastern Madagascar

RESULTS

I. Forest Vertebrate Inventory

In total, 27 mammal species, 106 bird species, 46 reptile species, and at least six amphibian species were recorded by previous studies and our observations (Tables 1–4).

The local informants recognized at least 16 mammals, 58 birds, 21 reptiles, and one amphibian (Tables 1–4). Among 185 forest vertebrate species, 49 species (three tenrecs and 46 birds) were recorded as potential bushmeat for the Tandroy. Hunting of these animals was reported to be mainly conducted by young men and not for subsistence. Hunting is likely opportunistic. According to the local informant, young men use slingshots to hunt birds and dogs for hunting tenrecs. According to the informant (at least in her opinion), although it is not wrong to gather food by hunting, it is cowardly of a man to spend most of his time in the forest without putting cattle out to pasture or cultivating crops, daily activity for the Tandroy.

II. Mammals

A total of 27 species of mammals (six lemurs, seven bats, five tenrecs, four mice, four carnivores, and one musk shrew) were reported in previous studies and this study (Table 1). Among the 27 species, eight species were introduced. 17 species were directly observed by the authors, and 10 species (six bats, two tenrecs, and two mice) were not. In addition to the reported species, 11 other species (one lemur, seven bats, one mouse, one carnivore, and one musk shrew) could potentially inhabit the reserve (Table 1) based on probable ranges of the mammalian species of Madagascar (Garbutt, 2007).

Lemurs (Order Primates) were the most intensively studied vertebrates in Berenty Reserve, with our Google Scholar search results including more lemur studies than studies on any other taxa. Six lemur species, including an introduced hybrid *Eulemur* species (*E. rufus* × *E. collaris*), are easily observed in the reserve. Strangely, the fat-tailed dwarf lemur (*Cheirogaleus medius*) was not observed, although this species may potentially inhabit the reserve (Mittermeier et al., 2010). Although Jenkins (1987) listed this species as one of the lemur species in Berenty, we could not find any evidence of this species in previous studies or information from the local guides and villagers.

According to the local informant, eating lemurs is strictly prohibited among the Tandroy. The informant explained that eating lemur is taboo (*fady* in the Malagasy language, *faly* in the Tandroy dialect), and anyone who eats lemur becomes afflicted with a severe sickness of the throat. She also told us a Tandroy tale about lemur: A long time ago, Tandroy children were beaten by their stepmother with a *sotrobe* (a ladle used for serving cooked rice), and the children escaped into the forest and decided not to return to their house. Then the children became the ring-tailed lemur (*Lemur catta*) and the Verreaux's sifaka (*Propithecus verreauxi*). Thus, lemurs are the same as humans, and it is strictly

prohibited to eat them for the Tandroy people. Locals also mentioned, in both a joking and serious manner, that other ethnic groups, especially the Tanosy people from the Fort Dauphin, eat lemurs.

At least seven species of bats (Order Chiroptera, one fruit bat and six microbats) have been reported in the Berenty Reserve (Table 1).

Table 1. List of mammals in Berenty Reserve (with potentially occurring species)

#	Order name	Family name	Scientific name	English name	Local name (this study)	Beza[a]	Sources
1	Primates	Cheirogaleidae	*Microcebus murinus*	Gray mouse lemur	hatake		1, 2, This study
2			*Microcebus griseorufus*	Gray-brown mouse lemur	hatake	*	1, 2, 3, This study
			(Cheirogaleus medius)[c]	(Fat-tailed dwarf lemur)			
3		Lepilemuridae	*Lepilemur leucopus*	White-footed sportive lemur	songike	*	1, 2, This study
4		Lemuridae	*Lemur catta*	Ring-tailed lemur	hira/maky	*	1, 2, This study
5			*Eulemur rufus*[b] × *E. collaris*[b]	Rufous brown lemur (hybrid with red-collared brown lemur)	gidro/varika		1, 2, This study
6		Indridae	*Propithecus verreauxi*	Verreaux's sifaka	sifaka	*	1, 2, This study
7	Chiroptera	Pteropodidae	*Pteropus rufus*	Madagascan flying fox	totonga/ fanihy	*	1, This study
			(Eidolon dupreanum)[c]	(Madagascar straw-coloured fruit bat)			
8		Emballonuridae	*Taphozous mauritianus*	Mauritian tomb bat	kananavy	*	1
9		Hipposideridae	*Hipposideros commersoni*	Commerson's leaf-nosed bat	kananavy	*	1, 4
10			*Triaenops rufus (T. menamena)*	Rufous trident bat	kananavy	*	4
			(Triaenops furculus)[c]	(Troussart's trident bat)			
11		Vespertilionidae	*Myotis goudoti*	Malagasy mouse-eared bat	kananavy	*	4
12			*Miniopterus* sp.	A species of long-fingered and bent-winged bat	kananavy		4
			(Miniopterus manavi)[c]	-			
			(Miniopterus fraterculus)[c]	(Lesser long-fingered bat)			
			(Miniopterus gleni)[c]	-			
13		Molossidae	*Mormopterus jugularis (Tadarida jugularis)*	Peters's goblin bat	kananavy	*	4
			(Mops midas)[c]	(Midas mastiff bat)			
			(Otomops madagascariensis)[c]	(Madagascar free-tailed bat)			
14	Lypotyphla (Afrosoricida)	Tenrecidae	*Tenrec ecaudatus*	Common tenrec	trandrake	*	1, 5, This study
15			*Setifer setosus*	Greater hedgehog tenrec	sokegne/ soke	*	1
16			*Echinops telfairi*	Lesser hedgehog tenrec	sora	*	1, This study
17			*Microgale* sp. *(Microgale taiva?)*	A species of shrew tenrec (Taiva shrew tenrec?)	-		1
18			*Geogale aurita*	Large-eared tenrec	-	*	6, This study
19	Rodentia	Muridae	*Eliurus myoxinus*	Western tuft-tailed rat (Madagascar tree-rat)	-	*	1
20			*Macrotarsomys bastardi*	Western big-footed mouse (Bastard big-footed mouse)	-	*	7
21			*Rattus rattus*[b]	Black rat	voalavo	*	1, 5, This study
22			*Mus musculus*[b]	House mouse	kotike	*	This study
			(Rattus norvegicus)[b, c]	(Brown rat)			
23	Carnivora	Eupleridae	*Galidia elegans*[b]	Ring-tailed mongoose	vontsira		8, This study
			(Cryptoprocta ferox)[c]	(Fossa)	(fosa)	*	
24		Viverridae	*Viverricula indica*[b]	Small Indian civet	fanaloka/ hahay	*	1, This study
25		Felidae	*Felis silvestris*[b]	Domestic cat	tsaka	*	This study
26		Canidae	*Canis lupus*[b]	Domestic dog	amboa		This study
27	Soricomorpha	Soricidae	*Suncus etruscus*[b]	Pygmy musk shrew	-	*	This study
			(Suncus murinus)[b, c]	(Asian musk shrew)		*	

a: Species recorded in the Beza Mahafaly Special Reserve (Richard et al., 2016)
b: Introduced species
c: Unrecorded species
Sources: 1. Jolly et al., 2006, 2. Mittermeier et al., 2010, 3. Yoder et al., 2002, 4. Fish 2012, 5. Karpanty & Goodman 1999, 6. Muldoon & Goodman 2010, 7. Koyama 2009, 8. Schnoell 2012.

Berenty is a Madagascan flying fox (*Pteropus rufus*) research site (Long & Racey, 2007; Rahaingodrahety et al., 2008), and tourists can observe roost trees there. Only a few roost sites have been located in the drier southern region of Madagascar (Long & Racey, 2007). Research on other bats was rare and information on microbats was mainly reported by Fish (2012). Fish (2012) recommends further bat surveys in Berenty, and the number of recorded species might increase with future research. Based on probable ranges (Garbutt, 2007), seven more species might be added to the known fauna of Berenty Reserve (Table 1).

The Tandroy classified bats using two names, "*totonga*" (fruit bat) and "*kananavy*" (microbat). Across Madagascar, "*fanihy*" is another common name for fruit bats and is also broadly used among the Tandroy people in this region. According to the local informant, some Tandroy people may eat *totonga* (*Pteropus rufus*), but this is not common in this region. She had never eaten the meat and explained that this is because fruit bat faces look like mice or lemurs.

At least five species of tenrecs (Order Afrosoricida) have been reported in Berenty Reserve (Table 1). Two species of tenrecs (*Tenrec ecaudatus* and *Echinops telfairi*) were directly observed by authors (Ichino, Maehata, and Rakotondrapararany). Another smaller tenrec (*Geogale aurita*) has been captured by an author (Rakotondraparany) previously in this reserve.

According to the local informant, the local people recognize only three larger species of tenrecs that are commonly consumed as bushmeat. She has eaten all three species of tenrecs and could explain differences in their flavor. She also explained that local men often hunt these species using dogs.

At least four species of mice (Order Rodentia), two native and two introduced, have been reported in Berenty Reserve (Table 1). Although another introduced species, the brown rat (*Rattus norvegicus*) occurs throughout Madagascar, we could not confirm its presence in the reserve.

The local people recognize only the two introduced mice and not the native forest-dwelling mice. The local informant explained that mice go to the forest in the daytime and return to the village at night. The mice were not regarded as food for the Tandroy people.

Only four species of carnivores (Order Carnivora) were recorded in the Berenty Reserve, and all are introduced (Table 1). Native carnivores do not inhabit the reserve as far as we know. No evidence of the fossa (*Cryptoprocta ferox*), the largest carnivore in Madagascar and largest lemur predator, was found, although the local people mentioned this species anecdotally, and Muldoon & Goodman (2010) considered this species present in Berenty. The most commonly observed carnivore was the small Indian civet (*Viverricula indica*). We directly observed this species on several occasions. Our main informant called this species "*fanaloka*." *Fanaloka* is a common name of the Malagasy civet (*Fossa fossana*). However, other locals called this species "*hahay*," which is a homonym of the nocturnal lemur, the aye-aye (*Daubentonia madagascariensis*). Although some locals claimed that *fanaloka* and *hahay* are different species, our camera trap survey confirmed only one small carnivore species, the small Indian civet (*Viverricula indica*) (Fig. 2).

Stray dogs and cats were commonly observed in our camera trapping data. An

author (Ichino) often observed ring-tailed lemurs (*Lemur catta*) emitting alarm calls and in some cases, directly observed dogs or cats. At least three individual dogs and two individual cats were observed on camera traps and directly observed in 2016 and 2017.

Carnivores were not regarded as food by the Tandroy. Dog especially is a strong taboo animal. If one ate a dog, he or she would be socially excluded by other villagers and could not be buried in his family tomb. This taboo is also seen among the Tanosy people who can eat other animals considered taboo by the Tandroy (e.g., lemurs, cats, and turtles). The local people discriminate between domestic cats (*piso*) and wild cats (*tsaka*). It is also taboo for the Tandroy people to sell cats. Instead of money, cats are paid for with a needle (*fanjaitra*) and a tray for winnowing rice (*tsikele*).

The ring-tailed mongoose (*Galidia elegans*) is a puzzling carnivore species. It is believed to occur mainly in eastern rainforests, and the Berenty Reserve is beyond the estimated distribution of this species (Garbutt, 2007). However, this species was observed in 2012 in Berenty (Schnoell, 2012) and captured by reserve staff. This species has not been observed since. It is unknown whether the ring-tailed mongoose was introduced or naturally occurs infrequently in Berenty.

Although this species is normally absent in this area, it is commonly known among the locals because its tail is believed to be a medicine for easy childbirth and severe sickness. According to the local informant, pregnant women use the tail of this species as a necklace (*besarogne*). An author (Ichino) observed the tail being sold in a market near Fort Dauphin in 2017.

One species of shrew (*Suncus etruscus*, Order Soricomorpha) was captured during our short-term pit-fall trap survey in August 2017 (Fig. 3). However, the introduced Asian musk shrew (*Suncus murinus*) has not been recorded in Berenty Reserve (Table 1), despite widely occurring in Madagascar (Garbutt, 2007). The local informant did not recognize these species.

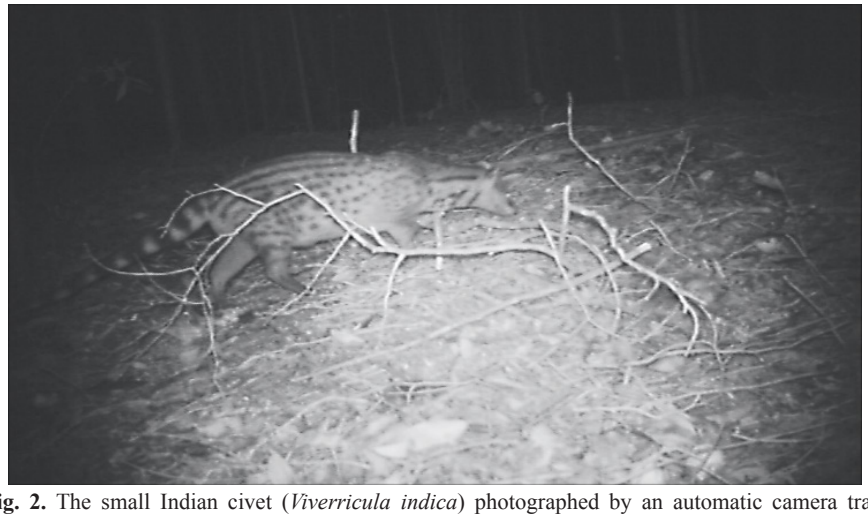

Fig. 2. The small Indian civet (*Viverricula indica*) photographed by an automatic camera trap

Fig. 3. The pygmy musk shrew (*Suncus etruscus*) captured in a pit-fall trap

III. Birds

A comprehensive bird list for Berenty Reserve has been reported by Goodman et al. (1997). Goodman et al. reported a list of 100 species of birds (Table 6 of Goodman et al. 1997) based on several years of intensive fieldwork conducted by the ornithologist, Mark Pidgeon. In this study, we added six more bird species to the list (Table 2). Three species were added based on the bird list by Koyama (2009); the black heron (*Egretta ardesiaca*), the hamerkop (*Scopus umbretta*), and the Meller's duck (*Anas melleri*). Although Goodman et al. (1997) noted that they observed black heron and hamerkop in Berenty, they did not include these species on their list. We also added the greater flamingo (*Phoenicopterus roseus*), because this species was observed by locals and seen flying over Berenty on several occasions by Goodman et al. (1997). Finally, the Malagasy pond heron (*Ardeola idea*) and the subdesert brush warbler (*Nesillas lantzii*) were added based on an author's (Maehata) direct observation. In total, 106 bird species were recorded in Berenty (Table 2).

Among the 106 bird species, at least two species, the Madagascar harrier-hawk (*Polyboroides radiatus*) and the Madagascar crested ibis (*Lophotibis cristata*), are likely to go extinct from Berenty. The Madagascar harrier-hawk had been observed in the reserve until the early 2000s, but it has not been observed since the late 2000s. Goodman et al. (1997) reported at least three active *P. radiatus* nest sites in the mid-1980s. The Madagascar crested ibis has not been observed for 30 years or more. Although previously reported from Berenty (Langrand, 1990), Mark Pidgeon did not observe this species over 2.5 years of intensive fieldwork in the

mid-1980s (Goodman et al., 1997) and neither did we during our surveys.

Sixty-four local names of birds were recorded during the study period. These names represented 61 species; some names corresponded to two species (e.g., *tsipiritse*) and some species had synonymous names (e.g., *kotrohake* and *toloho* for *Centropus toulou*) (Table 2). Local names of birds we collected were nearly identical to those reported by Koyama (2009) and Goodman et al. (1997) (Table 2).

An author (Maehata) recorded 60 species of birds during his fieldwork in Berenty (Table 2). The local informant recognized 45 of the species (75.0%) and did not recognize some water birds, raptors, and small birds. While the local informant was confident with most bird names, she seemed to lack knowledge concerning some bird groups; she was uncertain about the names of some water birds (e.g., *dagnake*), raptors (e.g., *fondria, firasa*), and Vangidae species (e.g., *andriobakia*) (see Table 2).

According to the local informant, most birds are potentially used as bushmeat, and only 11 species are not considered edible by the Tandroy (Table 2). The local informant could not explain why several species were inedible (reed cormorant, hamerkop, black kite, Madagascar paradise flycatcher, pied crow, and common myna). She inferred that the crested drongo (*Dicrurus forficatus*) is not eaten because it is considered a king of the birds of Madagascar in a famous Malagasy tale (*Mpanjakan'ny vorona*). The Tandroy have a similar tale about the Madagascar cuckoo (*Cuculus rochii*), in which the cuckoo is thought of as a king because it provides food to other birds.

Three nocturnal bird species are also not regarded as food among the Tandroy. The local informant explained that the barn owl (*Tyto alba*) is believed to bring calamity. When people see this bird flying overhead, they beat on their house walls to avoid the calamity. The Tandroy also believe that imitating the call of a white-browed owl (*Ninox superciliaris*) at night causes clothes to catch fire and thus, should be avoided. The local people seem to have generally negative impressions of nocturnal species.

The Namaqua dove (*Oena capensis*) is a case of a changing food taboo. There is a Tandroy tale in which a man was helped by a Namaqua dove, and the Tandroy people thereafter considered it taboo to eat the bird. Recently, however, younger generations have begun to eat them.

Table 2. List of birds in Berenty Reserve

#	Order name	Family name	Scientific name	English name	Local name (this study)	Local name (Koyama, 2009)	Local name (Goodman et al., 1997)	Bushmeat	Beza[a]	This study[b]
1	Suliformes	Phalacrocoracidae	*Phalacrocorax africanus (Microcarbo africanus)*	Reed cormorant	razamboay	-	razamboay	No	*	
2	Pelecaniformes	Ardeidae	*Nycticorax nycticorax*	Black-crowned night heron	-	goandrano	-	-	*	*
3			*Ardeola ralloides*	Squacco heron	-	-	-	-		*
4			*Ardeola idea*	Malagasy pond heron	-	-	-	-		*
5			*Butorides striata*	Striated heron	-	-	-	-	*	*
6			*Ardea ibis (Bubulcus ibis)*	Cattle egret	vorompoty	vorompotsy	-	Yes	*	*
7			*Egretta dimorpha*	Dimorphic heron	(sangoake)[c]	voropotse	-	Yes	*	*
8			*Egretta ardesiaca*	Black heron	-	lombokoma	-	-		
9			*Ardea alba (Egretta alba)*	Great egret	dagnake[d]	vagno	-	Yes	*	*
10			*Ardea purpurea*	Purple heron	-	-	-	-		*
11			*Ardea cinerea*	Gray heron	-	-	-	-	*	
12			*Ardea humbloti*	Madagascar heron	-	-	-	-		
13		Scopidae	*Scopus umbretta*	Hamerkop	takatra	-	takatsy	No	*	
14		Threskiornithidae	*Lophotibis cristata*	Madagascar crested ibis	akohoanala	-	akoala	Yes		
15	Phoenicopteriformes	Phoenicopteridae	*Phoenicopterus roseus*	Greater flamingo	(sama)[c]	-	-	?		
16	Anseriformes	Anatidae	*Dendrocygna bicolor*	Fulvous whistling duck	-	-	-	-		
17			*Dendrocygna viduata*	White-faced whistling duck	tsiriry	tsiriry	tsiriry	Yes	*	
18			*Sarkidiornis melanotos*	Comb duck	(ongoongo)[c]/befeko[d]	ongoongo	ongongo	Yes	*	
19			*Anas erythrorhyncha*	Red-billed teal	-	-	-	-	*	
20			*Anas melleri*	Meller's duck	tsiriry	tsiriry	-	Yes		
21	Accipitriformes	Accipitridae	*Aviceda madagascariensis*	Madagascar cuckoo-hawk	-	-	-	-		*
22			*Macheiramphus alcinus*	Bat hawk	-	-	-	-		
23			*Milvus migrans (Milvus aegyptius)*	Black kite	tsimalaho	tsimalaho	tsimala	No	*	*
24			*Polyboroides radiatus*	Madagascar harrier-hawk	fondria[d]	fihiake	fihiaka	Yes	*	
25			*Accipiter madagascariensis*	Madagascar sparrowhawk	firasa/fandriasa/fihiake/fanaoke[d]	fisidriky	-	Yes	*	
26			*Accipiter francesiae (A. francesii)*	Frances's sparrowhawk	firasa/fandriasa/fihiake/fanaoke[d]	firasa	fandraokibo	Yes		*
27			*Buteo brachypterus*	Madagascar buzzard	bevorotre	bevoritse	hondria/bevorotse	Yes	*	*
28	Falconiformes	Falconidae	*Falco newtoni*	Madagascar kestrel	rehiteke	hitsikitsike/hitsikitsiky	rehitriky	Yes	*	*
29			*Falco zoniventris*	Banded kestrel	-	-	-	-		

(continued)

#	Order name	Family name	Scientific name	English name	Local name (this study)	Local name (Koyama, 2009)	Local name (Goodman et al., 1997)	Bushmeat	Beza[a]	This study[b]
30			*Falco eleonorae*	Eleonora's falcon	-	-	-	-		
31			*Falco concolor*	Sooty falcon	-	firasambalala	-	-	*	
32			*Falco peregrinus*	Peregrine falcon	-	-	-	-		
33	Galliformes	Phasianidae	*Margaroperdix madagarensis*	Madagascar partridge	tsipoipoy	traotrao	-	Yes		
34			*Coturnix coturnix*	Common quail	-	-	-	-	*	
35		Numididae	*Numida meleagris*	Helmeted guineafowl	akanga	akanga	akanga	Yes	*	*
36	Charadriiformes	Turnicidae	*Turnix nigricollis*	Madagascar buttonquail	kibo	kibo	kibo	Yes	*	*
37	Gruiformes	Rallidae	*Dryolimnas cuvieri*	White-throated rail	-	tsikoza	-	-		*
38			*Porphyrio porphyrio*	Purple swamphen	-	-	-	-		
39		Rostratulidae	*Rostratula benghalensis*	Greater painted-snipe	-	-	-	-		
40	Charadriiformes	Charadriidae	*Charadrius pecuarius*	Kittlitz' plover	-	-	-	-		*
41			*Charadrius tricollaris*	Three-banded plover	-	-	-	-		
42		Scolopacidae	*Numenius phaeopus*	Whimbrel	-	-	-	-		
43			*Tringa nebularia*	Common greenshank	tsikoza	vivy	-	Yes		*
44			*Actitis hypoleucos*	Common sandpiper	monrita	mojotse	-	Yes	*	*
45			*Calidris ferruginea*	Curlew sandpiper	-	-	-	-		
46		Laridae	*Larus dominicanus (L. domesticus)*	Kelp gull	-	-	kolokoloky	-		
47			*Sternacaspia*	Caspian tern	-	-	-	-		
48		Pteroclidae	*Pterocles personatus*	Madagascar sandgrouse	hatrakatrake	hatrakatrake	hatrakatraka/ hatrakatra	Yes	*	*
49	Columbiformes	Columbidae	*Nesoenas picturatus (Streptopelia picturata)*	Madagascar turtle dove	deho	deho	deho	Yes	*	*
50			*Oena capensis*	Namaqua dove	tsikoloto	tsikoloto	tsikaloto	Yes	*	*
51			*Treron australis*	Madagascar green pidgeon	dehofona	dehofona	-	Yes	*	*
52	Psittaciformes	Psittaculidae	*Coracopsis vasa*	Greater vasa parrot	vazambe	vazambe	vazambe	Yes		*
53			*Coracopsis nigra*	Lesser vasa parrot	vazatsifotre	vazatsihoty	vazatsihotsy	Yes	*	*
54			*Agapornis canus (A. cana)*	Gray-headed lovebird	tsikariake	kitrehoke	farivaza/kariaka	Yes	*	*
55	Cuculiformes	Cuculidae	*Cuculus rochii*	Madagascar cuckoo	taotaokafa	taotaokafa	taotaokafo	No	*	
56			*Coua gigas*	Giant coua	eoke	eoke	eoka/aoka	Yes	*	*
57			*Coua cursor*	Running coua	aliotse	aliotse	aliotsy	Yes		*
58			*Coua ruficeps*	Red-capped coua	arefy	arefy	aliotsy	Yes	*	*
59			*Coua cristata*	Crested coua	tivoke	tivoke	tivoka	Yes	*	*
60			*Centropus toulou*	Madagascar coucal	kotrohake/toloho	toloho/kotohake	kotohake/toloho	Yes	*	*

(continued)

#	Order name	Family name	Scientific name	English name	Local name (this study)	Local name (Koyama, 2009)	Local name (Goodman et al., 1997)	Bushmeat	Beza[a]	This study[b]
61	Strigiformes	Tytonidae	*Tyto alba*	Barn owl	hekoheko	vorondolo/hanka	hekoheko/ vorondolo	No	*	
62		Strigidae	*Otus rutilus*	Malagasy scops owl	torotoroke	torotoroke	toro/torotoroka	No		
63			*Ninox superciliaris*	White-browed owl	vorondolo	vorondolo	vorondolo	No	*	*
64			*Asio madagascariensis*	Madagascar long-eared owl	-	hekoheko	-	-	*	
65			*Asio capensis*	Marsh owl	-	-	-	-		
66	Caprimulgiformes	Caprimulgidae	*Caprimulgus madagascariensis*	Madagascar nightjar	langopake	langopaky	langopaka	Yes	*	*
67	Apodiformes	Apodidae	*Zoonavena grandidieri*	Madagascar spine-tailed swift	-	-	-	-		*
68			*Apus barbatus*	African black swift	-	-	-	-		*
69	Coraciiformes	Alcedinidae	*Corythornis vintsioides (Alcedo vintsioides)*	Madagascar malachite kingfisher	revitsike	revitsy/vitsirano	bintitra	?	*	*
70			*Ispidina madagascariensis*	Malagasy pygmy kingfisher	revitsike	-	-	?		
71		Meropidae	*Merops superciliosus*	Olive bee-eater	-	kiriokirioky	kirikirioky/ tsikiriokirioke	-	*	*
72		Coraciidae	*Eurystomus glaucurus*	Broad-billed roller	tsirarako	tsirarako	tsiraraka	Yes	*	
73	Leptosomatiformes	Leptosomidae	*Leptosomus discolor*	Cuckoo-roller	treotreo	vorondreo/treotreo	vorondreo/ treotreo	Yes	*	
74	Bucerotiformes	Upupidae	*Upupa marginata (Upupa epops)*	Madagascar hoopoe	tsikodara	tsikodara	tsikodara	Yes	*	*
75	Passeriformes	Alaudidae	*Mirafra hova*	Madagascar lark	jirioke	jorioky	jorioke	Yes		*
76		Hirundinidae	*Phedina borbonica*	Mascarene martin	-	-	-	-		
77		Motacillidae	*Motacilla flaviventris*	Madagascar wagtail	-	-	triotrio	-		
78		Campephagidae	*Coracina cinerea*	Madagascar cuckoo-shrike	tsikariokarioke	kikiomavo	mavoloha/ tsirikititio	Yes	*	*
79		Pycnonotidae	*Hypsipetes madagascariensis*	Madagascar bulbul	tsikonina	tsikorova	tsikonina	Yes	*	*
80		Muscicapidae	*Copsychus albospecularis*	Madagascar magpie-robin	pidahy	pidahy	peeda	Yes	*	*
81			*Saxicola torquata (S. sibilla)*	African stonechat	-	-	-	-		
82		Acrocephalidae	*Acrocephalus newtoni*	Madagascar swamp warbler	-	andritike	-	-		
83			*Nesillas lantzii*	Subdesert brush warbler	(angorokitsike)[c]	-	-	?		*
84		Bernieridae	*Thamnornis chloropetoides*	Thamnornis	-	-	-	-	*	
85		Cisticolidae	*Cisticola cherina*	Madagascar cisticola	tsipiritse	tsipiritse	-	Yes		*
86			*Neomixis tenella*	Common jery	tsimitre	kimitre	tsimitsy	Yes	*	*
87			*Terpsiphone mutata (Neomixis striatigula)*	Stripe-throated jery	-	kimimitre	-	-	*	*
88		Vangidae	*Newtonia brunneicauda*	Common newtonia	andriobakia[d]	tretretre	andreabokia	Yes	*	*
89			*Newtonia archboldi*	Archbold's newtonia	-	-	-	-	*	*
90			*Calicalicus madagascariensis*	Red-tailed vanga	-	-	-	-		

(continued)

#	Order name	Family name	Scientific name	English name	Local name (this study)	Local name (Koyama, 2009)	Local name (Goodman et al., 1997)	Bushmeat	Beza[a]	This study[b]
91			*Vanga curvirostris*	Hook-billed vanga	tsilovango/fiokala[d]	tsilovanga	fifiokala/ tsilovanga	Yes	*	*
92			*Xenopirostris xenopirostris*	Lafresnaye's vanga	-	-	-	-		
93			*Falculea palliata*	Sickle-billed vanga	-	voronjaza	voronzaza	-	*	
94			*Artamella viridis (Leptopterus viridis)*	White-headed vanga	haranakake[d]	vanga/tretreky	vorompifkoka/ bifeko	Yes	*	*
95			*Leptopterus chabert*	Chabert vanga	-	soroanja	-	-	*	
96			*Cyanolanius madagascarinus*	Blue vanga	-	-	-	-		
97		Monarchidae	*Terpsiphone mutata*	Madagascar paradise flycatcher	remaly	rengetry	rimaly	No	*	*
98		Nectariniidae	*Nectarinia souimanga (Cinnyris sovimanga)*	Souimanga sunbird	-	soimanga	tsiksoysoy	-	*	*
99			*Nectarinia notata (Cinnyris notatus)*	Madagascar green sunbird	tsikisoisoy	soisoy	-	Yes		*
100		Zosteropidae	*Zosterops maderaspatanus (Zosterops maderaspatana)*	Madagascar white-eye	-	fotsimaso	bemaso	-	*	*
101		Dicruridae	*Dicrurus forficatus*	Crested drongo	railovy	lovy/relovy	lova	No	*	*
102		Corvidae	*Corvus albus*	Pied crow	koake	koaky	goaka	No	*	*
103		Sturnidae	*Acridotheres tristis*	Common myna	remaro	remaro	rimaro	No	*	*
104		Ploceidae	*Ploceus sakalava*	Sakalava weaver	foly	foly	fodibeotse	Yes	*	*
105			*Foudia madagascariensis*	Madagascar fody	folimena	fodilahimena/folimena	folymena	Yes	*	*
106		Estrildidae	*Lonchura nana*	Madagascar mannikin	tsipiritse	tsipiritse	tsipiritsy	Yes	*	*

a: Species recorded in the Beza Mahafaly Special Reserve (Rahendrimanana et al., 2016)

b: Species recorded by an author (Maehata, 2013)

c: Local name according to another informant (a 62-year-old man)

d: Uncertain species identification by a local informant (a 67-year-old woman)

IV. Reptiles

Reptiles have been relatively poorly studied in Berenty Reserve. A total of 46 species of reptiles (one crocodile, two chameleons, nine geckos, two iguanas, 10 skinks, 19 snakes, and three turtles) were recorded (Table 3). The Tandroy people do not regard reptiles as food.

Only two chameleon species inhabit the reserve, and both of them are commonly observed. The local people regard them as male and female of the same species: the larger species, the spiny chameleon (*Furcifer verrucosus*) is considered the male, and the smaller species, the carpet chameleon (*F. lateralis*), as female. The local people believe that chameleons have poison in their feces and avoid touching them. According to the local informant, chameleons hate tobacco and can be killed by filling their noses with tobacco.

Snakes are relatively well recorded in Berenty since most of them can be easily observed by researchers and locals. A total of 19 species of snakes were recorded and most diurnal species were observed by the authors. The local people believe that snakes are dangerous animals despite being non-poisonous and well identified by the locals. The local people classified snakes into at least 10 names (Table 3). Two types of snake (*famaliakoho* and *fandrefiala*) are killed by locals because they are believed to cause calamity. The local people largely prefer not to kill other snakes. They especially avoid killing Bernier's striped snakes (*Dromicodryas bernieri*), because it is believed that if someone kills this snake, the snake's family visit the killer's house. The local name of this snake is "*merekavagna*" which means "friend snake." According to our secondary informant, the Tandroy sometimes call this species "*marolongo*," which means "many friends," as this snake lives in holes with many conspecifics. The people consider "*menara*" (*Leioheterodon madagascariensis*) as the most dangerous snake and fear it.

The Nile crocodile (*Crocodylus niloticus*) was rarely observed in this region. The local informant had never seen a crocodile directly but saw their footprints along the Mandrare River. A tour guide had observed crocodiles in the river a few years before our surveys. Our informant mentioned that her ex-husband knew a woman who was killed by a crocodile when he was still young. These stories suggest that crocodiles are rarely observed but do inhabit the Mandrare River.

Two tortoise species and one freshwater turtle were reported in the reserve (Table 3), although they were rarely observed. Jenkins (1987) reported the presence of the Madagascan big-headed turtle (*Erymnochelys madagascariensis*) in Berenty, but this is probably a misidentification of the African helmeted turtle (*Pelomedusa subrufa*) based on the distributions of these two species (see Glaw & Vences, 2007). All tortoises and turtles are taboo animals that the Tandroy do not eat.

At least 21 other reptiles (lizard, geckos, iguanas, and skinks) have been reported in the reserve (Table 3). However, this number will probably increase with future research since several species (e.g., *Trachylepis vato*) have been reported in Amboasary-sud, which is located along the same river and only about 12 km from Berenty Reserve (Glaw & Vences, 2007).

Table 3. List of reptiles in Berenty Reserve

#	Order name	Family name	Scientific name	English name	Local name (this study)	Sources
1	Crocodilia	Crocodylidae	*Crocodylus niloticus*	Nile crocodile	voay/voainbato	1, This study
2	Squamata	Chamoelieonidae	*Furcifer verrucosus (Chamaeleo verrucosus)*	Spiny chameleon	sakorikita (lahy)	1, 2, This study
3			*Furcifer lateralis (Chamaeleo lateralis)*	Carpet chameleon	sakorikita (vavy)	1, 3, This study
4		Gerrhosauridae	*Tracheloptychus madagascariensis*	Madagascar girdled lizard	-	1, 3, 4, This study
5			*Zonosaurus trilineatus*	Three-lined girdled lizard	rosonambelahy	1, 4, This study
6		Gekkonidae	*Geckolepis typica*	Grandidier's gecko	tsatsake	1, 5
7			*Hemidactylus mercatorius*	African house gecko	tsatsake	1
8			*Lygodactylus tuberosus*	Southern dwarf gecko	-	1, This study
9			*Lygodactylus decaryi*	Angel's dwarf gecko	-	6
10			*Paroedura androyensis*	Grandidier's Madagascar ground gecko	jirifo	1
11			*Paroedura bastardi*	Mocquard's madagascar ground gecko	jirifo	1, 4, This study
12			*Paroedura picta (P. pictus)*	Ocelot gecko	jirifo	1, 4, 7, 8, This study
13			*Phelsuma modesta*	Modest day gecko	tsatsake	1
14			*Phelsuma mutabilis*	Thick tail gecko	tsatsake	1, 4
15		Opluridae	*Chalarodon madagascariensis*	Malagasy collared lizard	rosopasigne	1, 3, 4, This study
16			*Oplurus cyclurus*	Merrem's Madagascar swift	sitry	1, This study
17		Scindidae	*Madascincus igneocaudatus (Amphiglossus igneocaudatus)*	Red-tailed skink	rosomalama	1, This study
18			*Amphiglossus ornaticeps*	Gray skink	rosomalama	1
19			*Androngo trivittatus*	-	rosomalama	1, 4
20			*Trachylepis aureopunctata (Mabuya aureopunctata)*	Gold-spotted mabuya	rosomalama	1, This study
21			*Trachylepis elegans (Mabuya elegans)*	Elegant mabuya	rosomalama	1, This study
22			*Trachylepis gravenhorstii (Mabuya gravenhorstii)*	Gravenhorst's mabuya	rosomalama	1, This study
23			*Trachylepis dumasi (Mabuya dumasi)*	-	rosomalama	1, This study
24			*Voeltzkowia lineata*	-	rosomalama	1, This study
25	Serpentes	Boidae	*Acrantophis dumerilii*	Dumeril's boa	bazy / bado	1, 2, 4, 9, This study
26			*Sanzinia madagascariensis*	Malagasy tree boa	bazy / bado	1, 4, This study
27		Lamprophiidae	*Dromicodryas bernieri*	Bernier's striped snake	merekavagna	1, 2, This study
28			*Dromicodryas quadrilineatus*	Four-striped snake	-	3
29			*Heteroliodon occipitalis*	Lamprophiid snake	-	1, 4
30			*Ithycyphus oursi*	-	fandrefiala	1, 4, This study
31			*Langaha madagascariensis (L.nasuta)*	Madagascar leaf-nosed snake	famaliakoho	1
32			*Langaha alluaudi*	Southern leafnose snake	famaliakoho	This study
33			*Leioheterodon geayi*	Speckled hognose snake	namalita	1, 2, This study
34			*Leioheterodon madagascariensis*	Malagasy giant hognose snake	menara	2, This study
35			*Leioheterodon modestus*	Blonde hognose snake	merenbitike	This study
36			*Liophidium torquatus*	White-lipped smooth snake	-	1, 4
37			*Liophidium vaillanti*	Lamprophiid snake	-	1
38			*Stenophis gaimardi (Lycodryas gaimardi)*	-	-	1
39			*Madagascarophis colubrinus*	-	lapetake	1, This study
40			*Mimophis mahfalensis*	Mahafaly sand snake	meremine	1, This study
41			*Pseudoxyrhopus kely*	Burrowing snake	-	1, 4, 10
42		Typhlopidae	*Ramphotyphlops braminus*	Brahminy blind snake	fatahotraandro	1, 4
43			*Typhlops arenarius (T. boettgeri)*	-	-	1, 11
44	Testudines	Pelomedusidae	*Pelomedusa subrufa*	African helmeted turtle	rere	12
45		Testudinae	*Astrochelys radiata (Geochelone radiata)*	Madagascar radiated tortoise	sokake	1, 12
46			*Pyxis arachnoides*	Spider tortoise	sokakenbato	1, 12

Sources: 1. Crowley, 1995, 2. Jenkins, 1987, 3. Karpanty & Goodman, 1999, 4. Glaw & Vences, 2007, 5. Köhler et al., 2009, 6. Röll et al., 2010 (referred to *L. verticillatus*, see Mezzasalma et al., 2017), 7. Jackman et al., 2008, 8. Gamble et al., 2008, 9. Orozco-Terwengel et al., 2008, 10. Ramanamanjato et al., 2007, 11. Wallach & Glaw, 2009, 12. Jolly et al., 2006.

Jenkins (1987) reported the presence of *Oplurus cuvieri* in Berenty, probably a misidentification of *O. cyclurus* based on the distributions of these two species. There is also confusion in the genus *Lygodactylus*. Röll et al. (2010) identified genetic samples from Berenty as *Lygodactylus verticillatus*. However, according to Glaw & Vences (2007), Berenty Reserve is beyond the distribution of *L. verticillatus*. Mezzasalma et al. (2017) suspected that there was a taxonomic misidentification and suggest that Röll et al. (2010) used an *L. decaryi* sample based on DNA sequence data. In this paper, we list *L. decaryi* following Mezzasalma et al. (2017), but further research is required.

Three species; the three-lined girdled lizard (*Zonosaurus trilineatus*), the Merrem's Madagascar swift (*Oplurus cyclurus*), and the Malagasy collared lizard (*Chalarodon madagascariensis*) are relatively common in the reserve and there are local names corresponding to each species (Table 3). Other species are classified into three local names; *jirifo*, *tsatsake*, and *rosomalama* (Table 3).

V. Amphibians

Amphibians are the most poorly studied taxa in Berenty. At least six species of frogs were recorded so far (Table 4). This number is most likely an underestimate and may increase with future research.

Local knowledge on amphibians was also relatively poor. According to the local informant, locals believe that only one type of frog, called the "*sahona*," inhabits the reserve. Frogs were not considered bushmeat nor used for any other purpose (e.g., poison for blow darts), so it is unsurprising that locals were unfamiliar with them.

Table 4. List of amphibians in Berenty Reserve

#	Order name	Family name	Scientific name	English name	Source
1	Anura	Ptychadenidae	*Ptychadena mascareniensis*	Mascarene grass frog	This study
2		Hyperoliidae	*Heterixalus boettgeri*	Boettger's reed frog	1
3		Microhylidae	*Scaphiophryne brevis*	Brown rain frog	2, 3
4			*Scaphiophryne calcarata*	Moquard's burrowing frog	2, 3
5		Mantellidae	*Boophis xerophilus*	-	3, 4
6			*Laliostoma labrosum*	Madagascar bullfrog	3, 5

Source: 1. Crowley, 1995, 2. Glos et al., 2005, 3. Glaw & Vences, 2007, 4. Glos & Linsenmair, 2005, 5. Pabijan et al., 2015.

DISCUSSION

Berenty Reserve is a protected forest in Madagascar and has been a long-term field research site since 1963 (Jolly et al., 2006). In this study, we created a list of forest vertebrate fauna of Berenty Reserve by compiling available scientific publications and our observations. We found that, in spite of more than 50-years of research history (Jolly, 2012), most researchers had focused on lemur ecology and behavior, and scientific knowledge is still lacking concerning some vertebrate

taxa, namely, bats, small mammals, most reptiles, and amphibians. These animals were also less recognized by the local informant. The local Tandroy people may have relatively poor knowledge of forest vertebrates although they have a rich knowledge of forest plants (Yuasa et al., 2000). This lack of knowledge concerning forest animals is probably because the Tandroy people who live in the south central region can be considered agro-pastoralists and do not hunt for subsistence (O'Connor, 1987). Also, our informant emphasized that working in the forest is not looked upon favorably by the Tandroy. Thus, this study suggests that the agro-pastoralist, socio-cultural background of the Tandroy has affected their knowledge of forest animals.

Since the chief informant in this study was a woman who had lived in the reserve for 10 years, her knowledge may be biased by her sex and experiences. More extensive field interviews may be required to understand the local knowledge of this region. However, we believe that our results were representative of this knowledge since we confirmed that our main informant's information was similar to that of other informants, including the 62-year-old man.

We suggest that small animals could potentially go extinct without being noticed, as they have received less scientific and local interest, despite the reserve's more than 50-year history as a research site (Jolly, 2012). We suggest that neglect of these small animals poses a potential risk for vertebrate biodiversity in this small forest.

In this study, we found that 27 mammalian species (including 19 endemic), 106 birds, and at least 52 herpetofauna (46 reptiles and six amphibians) inhabit the Berenty Reserve. In spite of the reserve' small size, the number of species is larger than that reported in Bezà Mahafaly Special Reserve (BMSR), another long-term research site in southwestern Madagascar. BMSR protects a much larger area (4,200 ha of forest contiguous with broad stretches of surrounding forest) (Sussman & Ratsirarson, 2006), 24 mammalian species (including 16 endemic) (Richard et al., 2016), 73 bird species (Rahendrimanana et al., 2016), and 41 herpetofauna (36 reptiles and 5 amphibians) (Ranaivonasy et al., 2016). The mammal and bird fauna of Berenty Reserve was similar to that of BMSR. 21 out of 24 mammalian species (87.5%) and 62 out of 73 bird species (84.9%) reported in BMSR were also recorded in Berenty. This suggests that Berenty still has relatively high mammal and bird diversity for its size. The Mandrare River along Berenty Reserve is the largest river in southern Madagascar and a permanent river which may attract bird species in the dry season and help to keep biodiversity high in this region.

This study also suggests that some large animals were locally extinct. The fossa (*Cryptoprocta ferox*), the largest native Malagasy carnivore and the Madagascar crested ibis (*Lophotibis cristata*) have not been observed for 30 years or more. The Madagascar harrier-hawk (*Polyboroides radiatus*) has not been observed in the past 10 years. These results suggest that large carnivores and raptors are likely to become extinct in small forest fragments.

Bushmeat Consumption

Three species of tenrecs and more than 46 species of birds were regarded as food for the Tandroy people in this region. Thus, birds are potentially facing hunting pressure from the local people, and small protected forests may serve as refuges. Our findings, however, suggest that bushmeat hunting is an opportunistic activity around Berenty Reserve and that hunting pressure on vertebrates may be much lower than that in other parts of Madagascar (Gardner & Davies, 2014; García & Goodman, 2003; Golden, 2009). This relatively low hunting pressure is fortunate for vertebrate conservation in the region. However, hunting pressure may change due to other local factors (Gardner & Davies, 2014) and ecological, economic, and cultural changes in the local society should be considered as potentially harmful to vertebrate diversity.

It is worth emphasizing that some food taboos (*fady*) still protect lemurs, carnivores, and turtles. Additionally, 11 species of birds were not used as bushmeat. These species were the same as those described by Gardner & Davies (2014) except for the Madagascar hoopoe (*Upupa marginata*), which we found to be used as food in this study.

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